

WHAT IS CLAIMED IS:

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1. A robot arm mechanism comprising:
a handling member for supporting and handling an object;
5 a robot arm connected to the handling member, the robot arm comprising a first arm link having first and second end portion, a second arm link having first and second end portion, and a link retaining mechanism having a center line, the link retaining mechanism pivotably retaining the first and second arm links respectively at the first end portions of the first and second arm links and keeping parallel two
10 lines of the line passing through the first and second end portions of the first arm link and the symmetrical line with respect to the center line with the line passing through the first and second end portions of the second arm link, the link retaining mechanism comprising a first joint cross linkage including a first short link having first and second end portions, a first long link having first and second end portions and longer
15 than the first short link of the first joint cross linkage of the link retaining mechanism, the first short and long links of the first joint cross linkage of the link retaining mechanism pivotably connected with each other at the second end portion of the first short link of the first joint cross linkage of the link retaining mechanism and the first end portion of the first long link of the first joint cross linkage of the link retaining
20 mechanism, a second short link having first and second end portions and substantially equal in length to the first short link of the first joint cross linkage of the link retaining mechanism, the first long link of the first joint cross linkage of the link retaining mechanism and the second short link of the first joint cross linkage of the link retaining mechanism pivotably connected with each other at the second end portion of
25 the first long link of the first joint cross linkage of the link retaining mechanism and the first end portion of the second short link of the first joint cross linkage of the link retaining mechanism, and a second long link having first and second end portions and substantially equal in length to the first long link of the first joint cross linkage of the link retaining mechanism, the second short and long links of the first joint cross
30 linkage of the link retaining mechanism pivotably connected with each other at the second end portion of the second short link of the first joint cross linkage of the link retaining mechanism and the first end portion of the second long link of the first joint cross linkage of the link retaining mechanism, the second long link of the first joint cross linkage of the link retaining mechanism and the first short link of the first joint
35 cross linkage of the link retaining mechanism pivotably connected with each other at the second end portion of the second long link of the first joint cross linkage of the link retaining mechanism and the first end portion of the first short link of the first

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joint cross linkage of the link retaining mechanism under the state that the second long link of the first joint cross linkage of the link retaining mechanism is crossed with the first long link of the first joint cross linkage of the link retaining mechanism, and a second joint cross linkage including a first short link having first and second end portions, a first long link having first and second end portions and longer than the first short link of the second joint cross linkage of the link retaining mechanism, the first short and long links of the second joint cross linkage of the link retaining mechanism pivotably connected with each other at the second end portion of the first short link of the second joint cross linkage of the link retaining mechanism and the first end portion of the first long link of the second joint cross linkage of the link retaining mechanism, a second short link having first and second end portions and substantially equal in length to the first short link of the second joint cross linkage of the link retaining mechanism, the first long link of the second joint cross linkage of the link retaining mechanism and the second short link of the second joint cross linkage of the link retaining mechanism pivotably connected with each other at the second end portion of the first long link of the second joint cross linkage of the link retaining mechanism and the first end portion of the second short link of the second joint cross linkage of the link retaining mechanism, and a second long link having first and second end portions and substantially equal in length to the first long link of the second joint cross linkage of the link retaining mechanism, the second short and long links of the second joint cross linkage of the link retaining mechanism pivotably connected with each other at the second end portion of the second short link of the second joint cross linkage of the link retaining mechanism and the first end portion of the second long link of the second joint cross linkage of the link retaining mechanism, the second long link of the second joint cross linkage of the link retaining mechanism and the first short link of the second joint cross linkage of the link retaining mechanism pivotably connected with each other at the second end portion of the second long link of the second joint cross linkage of the link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the link retaining mechanism under the state that the second long link of the second joint cross linkage of the link retaining mechanism is crossed with the first long link of the second joint cross linkage of the link retaining mechanism, the length ratio of each of the first and second short links of the first joint cross linkage of the link retaining mechanism to each of the first and second long links of the first joint cross linkage of the link retaining mechanism substantially equal to the length ratio of each of the first and second short links of the second joint cross linkage of the link retaining mechanism to each of the first and second long links of the second joint cross linkage

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5 of the link retaining mechanism, the first short link of the first joint cross linkage of the link retaining mechanism integrally formed with and in parallel relationship with the first long link of the second joint cross linkage of the link retaining mechanism under the state that the second end portion of the first short link of the first joint cross linkage of the link retaining mechanism is connected with the first end portion of the first long link of the second joint cross linkage of the link retaining mechanism, the first long link of the first joint cross linkage of the link retaining mechanism integrally formed with and in parallel relationship with the first short link of the second joint cross linkage of the link retaining mechanism under the state that the first end portion of the first long link of the first joint cross linkage of the link retaining mechanism is connected with the second end portion of the first short link of the second joint cross linkage of the link retaining mechanism, the first end portion of any one of the first and second arm links integrally formed with the second short link of the first joint cross linkage of the link retaining mechanism, the first end portion of the other one of the first and second arm links integrally formed with the second long link of the second joint cross linkage of the link retaining mechanism; and

a robot arm driving mechanism for driving the robot arm.

2. A robot arm mechanism as set forth in claim 1 in which the center line passes through the first and second end portions of the first long link of the first joint cross linkage of the link retaining mechanism, the first end portions of the first and second arm links positioned on the center line, the first short and long links of the first joint cross linkage of the link retaining mechanism respectively in coaxial relationship with the first long and short links of the second joint cross linkage of the link retaining mechanism.

3. A robot arm mechanism as set forth in claim 2 in which the robot arm further comprises:

30 a third arm link having first and second end portions, the handling member having first and second portions, the third arm link and the handling member pivotably connected with each other at the second end portion of the third arm link and the first portion of the handling member;

35 a fourth arm link having first and second end portions, the fourth arm link and the handling member pivotably connected with each other at the second end portion of the fourth arm link and the second portion of the handling member, the first and second arm links substantially equal in length to each other, the third and fourth arm links substantially equal in length to each other;

a first joint mechanism retaining the first and third arm links respectively at the second end portion of the first arm link and the first end portion of the third arm link under the state that the first arm link is pivotable around the second end portion of the first arm link with respect to the third arm link; and

- 5 a second joint mechanism retaining the second and fourth arm links respectively at the second end portion of the second arm link and the first end portion of the fourth arm link under the state that the second arm link is pivotable around the second end portion of the second arm link with respect to the fourth arm link.

10 4. A robot arm mechanism as set forth in claim 3 in which the second end portion of the first arm link and the first end portion of the third arm link are connected with each other.

15 5. A robot arm mechanism as set forth in claim 3 in which the first short link of the first joint cross linkage of the link retaining mechanism and the first long link of the second joint cross linkage of the link retaining mechanism are substantially equal in length to each other.

20 6. A robot arm mechanism as set forth in claim 3 which further comprises an additional handling member for supporting and handling an object, the robot arm further comprising a fifth arm link having first and second end portions, the additional handling member having first and second portions, the fifth arm link and the additional handling member pivotably connected with each other at the second end portion of the fifth arm link and the first portion of the additional handling member,
25 the fifth arm link pivotably retained by the first joint mechanism at the first end portion of the fifth arm link, and a sixth arm link having first and second end portions, the sixth arm link and the additional handling member pivotably connected with each other at the second end portion of the sixth arm link and the second portion of the additional handling member, the fifth and sixth arm links substantially equal in length
30 to each other, the sixth arm link pivotably retained by the second joint mechanism at the first end portion of the sixth arm link.

35 7. A robot arm mechanism as set forth in claim 3 in which the first long link of the first joint cross linkage of the link retaining mechanism and the first short link of the second joint cross linkage of the link retaining mechanism are substantially equal in length to each other.

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8. A robot arm mechanism as set forth in claim 7 in which the robot arm further comprises:

- a fifth arm link having first and second end portion;
- a sixth arm link having first and second end portion;

- 5 an additional link retaining mechanism having an additional center line, the additional link retaining mechanism pivotably retaining the fifth and sixth arm links respectively at the first end portions of the fifth and sixth arm links and keeping parallel two lines of the line passing through the first and second end portions of the fifth arm link and the symmetrical line with respect to the additional center line with the line passing through the first and second end portions of the sixth arm link, the
 - 10 additional link retaining mechanism comprising a first joint cross linkage including a first short link having first and second end portions, a first long link having first and second end portions and longer than the first short link of the first joint cross linkage of the additional link retaining mechanism, the first short and long links of the first
 - 15 joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the first short link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism, a second short link having first and second end portions and substantially equal in
 - 20 length to the first short link of the first joint cross linkage of the additional link retaining mechanism, the first long link of the first joint cross linkage of the additional link retaining mechanism and the second short link of the first joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the first long link of the first joint cross linkage of the
 - 25 additional link retaining mechanism and the first end portion of the second short link of the first joint cross linkage of the additional link retaining mechanism, and a second long link having first and second end portions and substantially equal in length to the first long link of the first joint cross linkage of the additional link retaining mechanism, the second short and long links of the first joint cross linkage of the
 - 30 additional link retaining mechanism pivotably connected with each other at the second end portion of the second short link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the second long link of the first joint cross linkage of the additional link retaining mechanism, the second long link of the first joint cross linkage of the additional link retaining mechanism and the first short link of the first joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the
 - 35 second long link of the first joint cross linkage of the additional link retaining

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mechanism and the first end portion of the first short link of the first joint cross linkage of the additional link retaining mechanism under the state that the second long link of the first joint cross linkage of the additional link retaining mechanism is crossed with the first long link of the first joint cross linkage of the additional link retaining mechanism, and a second joint cross linkage including a first short link having first and second end portions, a first long link having first and second end portions and longer than the first short link of the second joint cross linkage of the additional link retaining mechanism, the first short and long links of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the first long link of the second joint cross linkage of the additional link retaining mechanism, a second short link having first and second end portions and substantially equal in length to the first short link of the second joint cross linkage of the additional link retaining mechanism, the first long link of the second joint cross linkage of the additional link retaining mechanism and the second short link of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the first long link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the second short link of the second joint cross linkage of the additional link retaining mechanism, and a second long link having first and second end portions and substantially equal in length to the first long link of the second joint cross linkage of the additional link retaining mechanism, the second short and long links of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the second short link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the second long link of the second joint cross linkage of the additional link retaining mechanism, the second long link of the second joint cross linkage of the additional link retaining mechanism and the first short link of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the second long link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism under the state that the second long link of the second joint cross linkage of the additional link retaining mechanism is crossed with the first long link of the second joint cross linkage of the additional link retaining mechanism, the length ratio of each of the first and second short links of the first joint cross linkage of the additional link retaining

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mechanism to each of the first and second long links of the first joint cross linkage of the additional link retaining mechanism substantially equal to the length ratio of each of the first and second short links of the second joint cross linkage of the additional link retaining mechanism to each of the first and second long links of the second joint cross linkage of the additional link retaining mechanism, the first short link of the first joint cross linkage of the additional link retaining mechanism integrally formed with and in parallel relationship with the first long link of the second joint cross linkage of the additional link retaining mechanism under the state that the second end portion of the first short link of the first joint cross linkage of the additional link retaining mechanism is connected with the first end portion of the first long link of the second joint cross linkage of the additional link retaining mechanism, the first long link of the first joint cross linkage of the additional link retaining mechanism integrally formed with and in parallel relationship with the first short link of the second joint cross linkage of the additional link retaining mechanism under the state that the first end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism is connected with the second end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism, the first end portion of any one of the fifth and sixth arm links integrally connected with the second short link of the first joint cross linkage of the additional link retaining mechanism, the first end portion of the other one of the fifth and sixth arm links integrally connected with the second long link of the second joint cross linkage of the additional link retaining mechanism, the first short and long links of the first joint cross linkage of the additional link retaining mechanism respectively in coaxial relationship with the first long and short links of the second joint cross linkage of the additional link retaining mechanism, the additional center line passing through the first and second end portions of the first long link of the first joint cross linkage of the additional link retaining mechanism, the first end portions of the fifth and sixth arm links positioned on the additional center line, the second end portion of the first arm link and the first end portion of the third arm link connected with each other, the second end portion of the second arm link and the first end portion of the fourth arm link connected with each other, the first long link of the first joint cross linkage of the additional link retaining mechanism and the first short link of the second joint cross linkage of the additional link retaining mechanism substantially equal in length to each other, the first long link of the first joint cross linkage of the link retaining mechanism integrally formed with and in parallel relationship with the first long link of the first joint cross linkage of the additional link retaining mechanism under the state that the first end portion of the first long link of the first joint cross linkage of the

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a first stabilizing parallelogram linkage comprising a first link having first and second end portions and substantially equal in length to the first arm link, the first link of the first stabilizing parallelogram linkage integrally formed with and in coaxial relationship with the first arm link under the state that the first end portion of the first link of the first stabilizing parallelogram linkage is connected with the first end portion of the first arm link, a second link having first and second end portions and substantially equal in length to the fifth arm link, the first and second links of the first stabilizing parallelogram linkage pivotably connected with each other at the second end portion of the first link of the first stabilizing parallelogram linkage and the first end portion of the second link of the first stabilizing parallelogram linkage, the second link of the first stabilizing parallelogram linkage integrally formed with and in parallel relationship with the third arm link under the state that the first end portion of the second link of the first stabilizing parallelogram linkage is connected with the first end portion of the third arm link, a third link having first and second end portions and substantially equal in length to the first link of the first stabilizing parallelogram linkage, the second and third links of the first stabilizing parallelogram linkage pivotably connected with each other at the second end portion of the second link of the first stabilizing parallelogram linkage and the first end portion of the third link of the first stabilizing parallelogram linkage, and a fourth link having first and second end portions and substantially equal in length to the second link of the first stabilizing parallelogram linkage, the third and fourth links of the first stabilizing parallelogram linkage pivotably connected with each other at the second end portion of the third link of the first stabilizing parallelogram linkage and the first end portion of the fourth link of the first stabilizing parallelogram linkage, the fourth and first links of the first stabilizing parallelogram linkage pivotably connected with each other at the second end portion of the fourth link of the first stabilizing parallelogram linkage and the first end portion of the first link of the first stabilizing parallelogram linkage under the state that the first link of the first stabilizing parallelogram linkage is in parallel relationship with the third link of the first stabilizing parallelogram linkage and that the second link of the first stabilizing parallelogram linkage is in parallel relationship with the fourth link of the first stabilizing parallelogram linkage, the fourth link of the first stabilizing parallelogram linkage integrally formed with and in coaxial relationship with the fifth arm link under the state that the second end portion of the fourth link of the first stabilizing parallelogram linkage is connected with the first end portion of the fifth arm link; and

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5 a second stabilizing parallelogram linkage comprising a first link having first and second end portions and substantially equal in length to the second arm link, the first link of the second stabilizing parallelogram linkage integrally formed with and in coaxial relationship with the second arm link under the state that the first end portion of the first link of the second stabilizing parallelogram linkage is connected with the first end portion of the second arm link, a second link having first and second end portions and substantially equal in length to the sixth arm link, the first and second links of the second stabilizing parallelogram linkage pivotably connected with each other at the second end portion of the first link of the second stabilizing parallelogram linkage and the first end portion of the second link of the second stabilizing parallelogram linkage, the second link of the second stabilizing parallelogram linkage integrally formed with and in parallel relationship with the fourth arm link under the state that the first end portion of the second link of the second stabilizing parallelogram linkage is connected with the first end portion of the fourth arm link, a third link having first and second end portions and substantially equal in length to the first link of the second stabilizing parallelogram linkage, the second and third links of the second stabilizing parallelogram linkage pivotably connected with each other at the second end portion of the second link of the second stabilizing parallelogram linkage and the first end portion of the third link of the second stabilizing parallelogram linkage, and a fourth link having first and second end portions and substantially equal in length to the second link of the second stabilizing parallelogram linkage, the third and fourth links of the second stabilizing parallelogram linkage pivotably connected with each other at the second end portion of the third link of the second stabilizing parallelogram linkage and the first end portion of the fourth link of the second stabilizing parallelogram linkage, the fourth and first links of the second stabilizing parallelogram linkage pivotably connected with each other at the second end portion of the fourth link of the second stabilizing parallelogram linkage and the first end portion of the first link of the second stabilizing parallelogram linkage under the state that the first link of the second stabilizing parallelogram linkage is in parallel relationship with the third link of the second stabilizing parallelogram linkage and that the second link of the second stabilizing parallelogram linkage is in parallel relationship with the fourth link of the second stabilizing parallelogram linkage, the fourth link of the second stabilizing parallelogram linkage integrally formed with and in coaxial relationship with the sixth arm link under the state that the second end portion of the fourth link of the second stabilizing parallelogram linkage is connected with the first end portion of the sixth arm link.

9. A robot arm mechanism as set forth in claim 3 in which the first joint mechanism comprises:

a first link having first and second end portions and substantially equal in length to the first arm link, the first link of the first joint mechanism integrally formed with and in coaxial relationship with the first arm link under the state that the first end portion of the first link of the first joint mechanism is connected with the first end portion of the first arm link;

a second link having first and second end portions, the first and second links of the first joint mechanism pivotably connected with each other at the second end portion of the first link of the first joint mechanism and the first end portion of the second link of the first joint mechanism, the second link of the first joint mechanism pivotably connected with the first end portion of the third arm link;

a third link having first and second end portions and substantially equal in length to the first link of the first joint mechanism, the second and third links of the first joint mechanism pivotably connected with each other at the second end portion of the second link of the first joint mechanism and the first end portion of the third link of the first joint mechanism; and

a fourth link having first and second end portions and substantially equal in length to the second link of the first joint mechanism, the third and fourth links of the first joint mechanism pivotably connected with each other at the second end portion of the third link of the first joint mechanism and the first end portion of the fourth link of the first joint mechanism, the fourth and first links of the first joint mechanism pivotably connected with each other at the second end portion of the fourth link of the first joint mechanism and the first end portion of the first link of the first joint mechanism under the state that the first link of the first joint mechanism is in parallel relationship with the third link of the first joint mechanism and that the second link of the first joint mechanism is in parallel relationship with the fourth link of the first joint mechanism, the second end portion of the fourth link of the first joint mechanism integrally connected with the first long link of the first joint cross linkage of the link retaining mechanism or the first short link of the second joint cross linkage of the link retaining mechanism.

10. A robot arm mechanism as set forth in claim 9 in which the robot arm further comprises a stabilizing mechanism including:

a first link having first and second end portions and substantially equal in length to the third arm link, the first link of the stabilizing mechanism integrally

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formed with and in coaxial relationship with the third arm link under the state that the first end portion of the first link of the stabilizing mechanism is connected with the first end portion of the third arm link;

5 a second link having first and second end portions, the first and second links of the stabilizing mechanism pivotably connected with each other at the second end portion of the first link of the stabilizing mechanism and the first end portion of the second link of the stabilizing mechanism, the second link of the stabilizing mechanism integrally formed with the handling member;

10 a third link having first and second end portions and substantially equal in length to the first link of the stabilizing mechanism, the second and third links of the stabilizing mechanism pivotably connected with each other at the second end portion of the second link of the stabilizing mechanism and the first end portion of the third link of the stabilizing mechanism; and

15 a fourth link having first and second end portions and substantially equal in length to the second link of the stabilizing mechanism, the third and fourth links of the stabilizing mechanism pivotably connected with each other at the second end portion of the third link of the stabilizing mechanism and the first end portion of the fourth link of the stabilizing mechanism, the fourth and first links of the stabilizing mechanism pivotably connected with each other at the second end portion of the 20 fourth link of the stabilizing mechanism and the first end portion of the first link of the stabilizing mechanism under the state that the first link of the stabilizing mechanism is in parallel relationship with the third link of the stabilizing mechanism and that the second link of the stabilizing mechanism is in parallel relationship with the fourth link of the stabilizing mechanism, the second end portion of the fourth link 25 of the stabilizing mechanism integrally connected with the second link of the first joint mechanism.

11. A robot arm mechanism as set forth in claim 10 in which the fourth link of the stabilizing mechanism has a set angle with respect to the second link of the first 30 joint mechanism to prevent the state that the first and third links of the stabilizing mechanism are positioned on a straight line while the robot arm driving mechanism drives the robot arm.

12. A robot arm mechanism as set forth in claim 3 in which the arm driving 35 mechanism comprises a first driving shaft rotatable around a rotation axis, and a second driving shaft in the form of a hollow shape to rotatably receive therein the first driving shaft and rotatable around the rotation axis.

13. A robot arm mechanism as set forth in claim 12 in which any one of the first and second driving shafts is integrally connected with the first long link of the first joint cross linkage of the link retaining mechanism and rotates the first long link of the first joint cross linkage of the link retaining mechanism around the rotation axis, and in which the other one of the first and second driving shafts rotates the first arm link around the first end portion of the first arm link.

14. A robot arm mechanism as set forth in claim 12 in which any one of the first and second driving shafts rotates the first arm link around the first end portion of the first arm link, and in which the other one of the first and second driving shafts rotates the second arm link around the first end portion of the second arm link.

15. A robot arm mechanism as set forth in claim 13 in which the robot arm further comprises a driving assist parallelogram linkage including a first link having first and second end portions and substantially equal in length to the distance between the rotation axis and the second end portion of the first arm link, the first link of the driving assist parallelogram linkage integrally formed with and in parallel relationship with the first long link of the first joint cross linkage of the link retaining mechanism, a second link having first and second end portions, the first and second links of the driving assist parallelogram linkage pivotably connected with each other at the second end portion of the first link of the driving assist parallelogram linkage and the first end portion of the second link of the driving assist parallelogram linkage, the second link of the driving assist parallelogram linkage integrally formed with and in parallel relationship with the first arm link, a third link having first and second end portions and substantially equal in length to the first link of the driving assist parallelogram linkage, the second and third links of the driving assist parallelogram linkage pivotably connected with each other at the second end portion of the second link of the driving assist parallelogram linkage and the first end portion of the third link of the driving assist parallelogram linkage, and a fourth link having first and second end portions and substantially equal in length to the second link of the driving assist parallelogram linkage, the third and fourth links of the driving assist parallelogram linkage pivotably connected with each other at the second end portion of the third link of the driving assist parallelogram linkage and the first end portion of the fourth link of the driving assist parallelogram linkage, the fourth and first links of the driving assist parallelogram linkage pivotably connected with each other at the second end portion of the fourth link of the driving assist parallelogram linkage and the first end

portion of the first link of the driving assist parallelogram linkage under the state that the first link of the driving assist parallelogram linkage is in parallel relationship with the third link of the driving assist parallelogram linkage and that the second link of the driving assist parallelogram linkage is in parallel relationship with the fourth link of the driving assist parallelogram linkage, any one of the first and second driving shafts integrally connected with the fourth link of the driving assist parallelogram linkage at the second end portion of the fourth link of the driving assist parallelogram linkage and rotating the fourth link of the driving assist parallelogram linkage around the rotation axis.

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16. A robot arm mechanism as set forth in claim 1 in which the center line is substantially equally spaced apart from the second end portion of the first long link of the first joint cross linkage of the link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the link retaining mechanism and in perpendicular relationship with the first long link of the first joint cross linkage of the link retaining mechanism, the first end portions of the first and second arm links positioned on the line passing through the first and second end portions of the first long link of the first joint cross linkage of the link retaining mechanism.

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17. A robot arm mechanism as set forth in claim 16 in which the first short and long links of the first joint cross linkage of the link retaining mechanism are respectively in coaxial relationship with the first long and short links of the second joint cross linkage of the link retaining mechanism.

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18. A robot arm mechanism as set forth in claim 16 in which the first short and long links of the first joint cross linkage of the link retaining mechanism are respectively in axial alignment with the first long and short links of the second joint cross linkage of the link retaining mechanism.

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19. A robot arm mechanism as set forth in claim 16 in which the robot arm further comprises:

a third arm link having first and second end portions;

a fourth arm link having first and second end portions, the first and second arm links substantially equal in length to each other, the third and fourth arm links substantially equal in length to each other, the arm driving mechanism comprising a first driving shaft rotatable around a rotation axis, and a second driving shaft in the form of a hollow shape to rotatably receive therein the first driving shaft and rotatable

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around the rotation axis, any one of the first and second driving shafts integrally connected with the second end portion of the third arm link and rotating the third arm link around the rotation axis, the other one of the first and second driving shafts integrally connected with the second end portion of the fourth arm link and rotating the fourth arm link around the rotation axis;

a first joint mechanism retaining the first and third arm links respectively at the second end portion of the first arm link and the first end portion of the third arm link under the state that the first arm link is pivotable around the second end portion of the first arm link with respect to the third arm link; and

a second joint mechanism retaining the second and fourth arm links respectively at the second end portion of the second arm link and the first end portion of the fourth arm link under the state that the second arm link is pivotable around the second end portion of the second arm link with respect to the fourth arm link.

20. A robot arm mechanism as set forth in claim 19 in which the handling member is integrally connected with the first long link of the first joint cross linkage of the link retaining mechanism.

21. A robot arm mechanism as set forth in claim 19 in which the first and third arm links are pivotably connected with each other at the second end portion of the first arm link and the first end portion of the third arm link, and in which the second and fourth arm links are pivotably connected with each other at the second end portion of the second arm link and the first end portion of the fourth arm link.

22. A robot arm mechanism as set forth in claim 19 which further comprising an additional handling member, the robot arm further comprising:

a fifth arm link having first and second end portion;

a sixth arm link having first and second end portion, the fifth and sixth arm links substantially equal in length to each other; and

an additional link retaining mechanism having an additional center line, the additional link retaining mechanism pivotably retaining the fifth and sixth arm links respectively at the first end portions of the fifth and sixth arm links and keeping parallel two lines of the line passing through the first and second end portions of the fifth arm link and the symmetrical line with respect to the additional center line with the line passing through the first and second end portions of the sixth arm link, the additional link retaining mechanism comprising a first joint cross linkage including a first short link having first and second end portions, a first long link having first and

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second end portions and longer than the first short link of the first joint cross linkage of the additional link retaining mechanism, the first short and long links of the first joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the first short link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism, a second short link having first and second end portions and substantially equal in length to the first short link of the first joint cross linkage of the additional link retaining mechanism, the first long link of the first joint cross linkage of the additional link retaining mechanism and the second short link of the first joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the second short link of the first joint cross linkage of the additional link retaining mechanism, and a second long link having first and second end portions and substantially equal in length to the first long link of the first joint cross linkage of the additional link retaining mechanism, the second short and long links of the first joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the second short link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the second long link of the first joint cross linkage of the additional link retaining mechanism, the second long link of the first joint cross linkage of the additional link retaining mechanism and the first short link of the first joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the second long link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the first short link of the first joint cross linkage of the additional link retaining mechanism under the state that the second long link of the first joint cross linkage of the additional link retaining mechanism is crossed with the first long link of the first joint cross linkage of the additional link retaining mechanism, and a second joint cross linkage including a first short link having first and second end portions, a first long link having first and second end portions and longer than the first short link of the second joint cross linkage of the additional link retaining mechanism, the first short and long links of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the first long link of the second joint cross linkage of the additional link retaining mechanism,

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5 a second short link having first and second end portions and substantially equal in length to the first short link of the second joint cross linkage of the additional link retaining mechanism, the first long link of the second joint cross linkage of the additional link retaining mechanism and the second short link of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the first long link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the second short link of the second joint cross linkage of the additional link retaining mechanism, and a second long link having first and second end portions and substantially equal in length to the first long link of the second joint cross linkage of the additional link retaining mechanism, the second short and long links of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the second short link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the second long link of the second joint cross linkage of the additional link retaining mechanism, the second long link of the second joint cross linkage of the additional link retaining mechanism and the first short link of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the second long link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism under the state that the second long link of the second joint cross linkage of the additional link retaining mechanism is crossed with the first long link of the second joint cross linkage of the additional link retaining mechanism, the length ratio of each of the first and second short links of the first joint cross linkage of the additional link retaining mechanism to each of the first and second long links of the first joint cross linkage of the additional link retaining mechanism substantially equal to the length ratio of each of the first and second short links of the second joint cross linkage of the additional link retaining mechanism to each of the first and second long links of the second joint cross linkage of the additional link retaining mechanism, the first short link of the first joint cross linkage of the additional link retaining mechanism integrally formed with and in parallel relationship with the first long link of the second joint cross linkage of the additional link retaining mechanism under the state that the second end portion of the first short link of the first joint cross linkage of the additional link retaining mechanism is connected with the first end portion of the first long link of the second joint cross linkage of the additional link retaining mechanism, the first long link of the first joint cross linkage of the additional link retaining mechanism integrally formed

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- 5 with and in parallel relationship with the first short link of the second joint cross linkage of the additional link retaining mechanism under the state that the first end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism is connected with the second end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism, the first end portion of any one of the fifth and sixth arm links integrally connected with the second short link of the first joint cross linkage of the additional link retaining mechanism, the first end portion of the other one of the fifth and sixth arm links integrally connected with the second long link of the second joint cross linkage of the additional link retaining mechanism, the first short and long links of the first joint cross linkage of the additional link retaining mechanism respectively in coaxial relationship with the first long and short links of the second joint cross linkage of the additional link retaining mechanism, the additional center line substantially equally spaced apart from the second end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism and in perpendicular relationship with the first long link of the first joint cross linkage of the additional link retaining mechanism, the first end portions of the fifth and sixth arm links positioned on the line passing through the first and second end portions of the first long link of the first joint cross linkage of the additional link retaining mechanism, the distance between the second end portion of the first long link of the first joint cross linkage of the link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the link retaining mechanism is substantially equal to the distance between the second end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism, the first joint mechanism retaining the fifth arm link at the second end portion of the fifth arm link under the state that the fifth arm link is pivotable around the second end portion of the fifth arm link with respect to the third arm link, the second joint mechanism retaining the sixth arm link at the second end portion of the sixth arm link under the state that the sixth arm link is pivotable around the second end portion of the sixth arm link with respect to the fourth arm link.
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- 35 23. A robot arm mechanism as set forth in claim 22 in which the handling member is integrally connected with the first long link of the first joint cross linkage of the link retaining mechanism and in which the additional handling member is

integrally connected with the first long link of the first joint cross linkage of the additional link retaining mechanism.

24. A robot arm mechanism as set forth in claim 22 in which first joint mechanism is formed by a link and has first and second end portions, the third arm link integrally connected with the first joint mechanism at the portion substantially equally spaced apart from the first and second end portions of the first joint mechanism under the state that first joint mechanism and the third arm link are in perpendicular relationship with each other, the first arm link and the first joint mechanism pivotably connected with each other at the second end portion of the first arm link and the first end portion of the first joint mechanism, the fifth arm link and the first joint mechanism pivotably connected with each other at the second end portion of the fifth arm link and the second end portion of the first joint mechanism, and in which second joint mechanism is formed by a link and has first and second end portions, the fourth arm link integrally connected with the second joint mechanism at the portion substantially equally spaced apart from the first and second end portions of the second joint mechanism under the state that second joint mechanism and the fourth arm link are in perpendicular relationship with each other, the second arm link and the second joint mechanism pivotably connected with each other at the second end portion of the second arm link and the first end portion of the second joint mechanism, the sixth arm link and the second joint mechanism pivotably connected with each other at the second end portion of the sixth arm link and the second end portion of the second joint mechanism.

25. A robot arm mechanism as set forth in claim 19 which further comprising an additional handling member, the robot arm further comprising:
 a fifth arm link having first and second end portion;
 a sixth arm link having first and second end portion;
 a seventh arm link having first and second end portion;
 a eighth arm link having first and second end portion, the fifth and sixth arm links substantially equal in length to each other, the seventh and eighth arm links substantially equal in length to each other;
 a third joint mechanism retaining the fifth and seventh arm links respectively at the second end portion of the fifth arm link and the first end portion of the seventh arm link under the state that the fifth arm link is pivotable around the second end portion of the fifth arm link with respect to the seventh arm link;
 a fourth joint mechanism retaining the sixth and eighth arm links respectively

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at the second end portion of the sixth arm link and the first end portion of the eighth arm link under the state that the sixth arm link is pivotable around the second end portion of the sixth arm link with respect to the eighth arm link; and

- an additional link retaining mechanism having an additional center line, the
- 5 additional link retaining mechanism pivotably retaining the fifth and sixth arm links respectively at the first end portions of the fifth and sixth arm links and keeping parallel two lines of the line passing through the first and second end portions of the fifth arm link and the symmetrical line with respect to the additional center line with the line passing through the first and second end portions of the sixth arm link, the
 - 10 additional link retaining mechanism comprising a first joint cross linkage including a first short link having first and second end portions, a first long link having first and second end portions and longer than the first short link of the first joint cross linkage of the additional link retaining mechanism, the first short and long links of the first joint cross linkage of the additional link retaining mechanism pivotably connected
 - 15 with each other at the second end portion of the first short link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism, a second short link having first and second end portions and substantially equal in length to the first short link of the first joint cross linkage of the additional link retaining mechanism, the first long link of the first joint cross linkage of the additional
 - 20 link retaining mechanism and the second short link of the first joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the second short link
 - 25 of the first joint cross linkage of the additional link retaining mechanism, and a second long link having first and second end portions and substantially equal in length to the first long link of the first joint cross linkage of the additional link retaining mechanism, the second short and long links of the first joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the
 - 30 second end portion of the second short link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the second long link of the first joint cross linkage of the additional link retaining mechanism, the second long link of the first joint cross linkage of the additional link retaining mechanism and the first short link of the first joint cross linkage of the additional link retaining
 - 35 mechanism pivotably connected with each other at the second end portion of the second long link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the first short link of the first joint cross

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linkage of the additional link retaining mechanism under the state that the second long link of the first joint cross linkage of the additional link retaining mechanism is crossed with the first long link of the first joint cross linkage of the additional link retaining mechanism, and a second joint cross linkage including a first short link having first and second end portions, a first long link having first and second end portions and longer than the first short link of the second joint cross linkage of the additional link retaining mechanism, the first short and long links of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the first long link of the second joint cross linkage of the additional link retaining mechanism, a second short link having first and second end portions and substantially equal in length to the first short link of the second joint cross linkage of the additional link retaining mechanism, the first long link of the second joint cross linkage of the additional link retaining mechanism and the second short link of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the first long link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the second short link of the second joint cross linkage of the additional link retaining mechanism, and a second long link having first and second end portions and substantially equal in length to the first long link of the second joint cross linkage of the additional link retaining mechanism, the second short and long links of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the second short link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the second long link of the second joint cross linkage of the additional link retaining mechanism, the second long link of the second joint cross linkage of the additional link retaining mechanism and the first short link of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the second long link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism under the state that the second long link of the second joint cross linkage of the additional link retaining mechanism is crossed with the first long link of the second joint cross linkage of the additional link retaining mechanism, the length ratio of each of the first and second short links of the first joint cross linkage of the additional link retaining mechanism to each of the first and second long links of the first joint cross linkage of

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the additional link retaining mechanism substantially equal to the length ratio of each of the first and second short links of the second joint cross linkage of the additional link retaining mechanism to each of the first and second long links of the second joint cross linkage of the additional link retaining mechanism, the first short link of the first joint cross linkage of the additional link retaining mechanism integrally formed with and in parallel relationship with the first long link of the second joint cross linkage of the additional link retaining mechanism under the state that the second end portion of the first short link of the first joint cross linkage of the additional link retaining mechanism is connected with the first end portion of the first long link of the second joint cross linkage of the additional link retaining mechanism, the first long link of the first joint cross linkage of the additional link retaining mechanism integrally formed with and in parallel relationship with the first short link of the second joint cross linkage of the additional link retaining mechanism under the state that the first end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism is connected with the second end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism, the first end portion of any one of the fifth and sixth arm links integrally connected with the second short link of the first joint cross linkage of the additional link retaining mechanism, the first end portion of the other one of the fifth and sixth arm links integrally connected with the second long link of the second joint cross linkage of the additional link retaining mechanism, the first short and long links of the first joint cross linkage of the additional link retaining mechanism respectively in coaxial relationship with the first long and short links of the second joint cross linkage of the additional link retaining mechanism, the additional center line substantially equally spaced apart from the second end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism and in perpendicular relationship with the first long link of the first joint cross linkage of the additional link retaining mechanism, the first end portions of the fifth and sixth arm links positioned on the line passing through the first and second end portions of the first long link of the first joint cross linkage of the additional link retaining mechanism, the distance between the second end portion of the first long link of the first joint cross linkage of the link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the link retaining mechanism is substantially equal to the distance between the second end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the

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5 additional link retaining mechanism, any one of the first and second driving shafts rotating the eighth arm link around the second end portion of the eighth arm link, the other one of the first and second driving shafts rotating the seventh arm link around the second end portion of the seventh arm link, the second end portions of the eighth and seventh arm links positioned on the rotation axis.

26. A robot arm mechanism as set forth in claim 25 in which the handling member is integrally connected with the first long link of the first joint cross linkage of the link retaining mechanism and in which the additional handling member is
10 integrally connected with the first long link of the first joint cross linkage of the additional link retaining mechanism.

27. A robot arm mechanism as set forth in claim 19 in which the robot arm further comprises:
15 a fifth arm link having first and second end portions;
a sixth arm link having first and second end portions, the fifth and sixth arm link substantially equal in length to each other;
a first stabilizing mechanism including a first link having first and second end portions, the first link of the first stabilizing mechanism integrally formed with
20 and in parallel relationship with the first arm link under the state that the second end portion of the first link of the first stabilizing mechanism is connected with the second end portion of the first arm link, a second link having first and second end portions, the first and second links of the first stabilizing mechanism pivotably connected with each other at the second end portion of the first link of the first stabilizing mechanism
25 and the first end portion of the second link of the first stabilizing mechanism, the second link of the first stabilizing mechanism integrally formed with and in axial alignment with the third arm link under the state that the first end portion of the second link of the first stabilizing mechanism is connected with the second end portion of the third arm link, a third link having first and second end portions and
30 substantially equal in length to the first link of the first stabilizing mechanism, the second and third links of the first stabilizing mechanism pivotably connected with each other at the second end portion of the second link of the first stabilizing mechanism and the first end portion of the third link of the first stabilizing mechanism, the third link of the first stabilizing mechanism integrally formed with and in parallel
35 relationship with the fifth arm link under the state that the first end portion of the third link of the first stabilizing mechanism is connected with the second end portion of the fifth arm link, and a fourth link having first and second end portions and substantially

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equal in length to the second link of the first stabilizing mechanism, the third and fourth links of the first stabilizing mechanism pivotably connected with each other at the second end portion of the third link of the first stabilizing mechanism and the first end portion of the fourth link of the first stabilizing mechanism, the fourth and first links of the first stabilizing mechanism pivotably connected with each other at the second end portion of the fourth link of the first stabilizing mechanism and the first end portion of the first link of the first stabilizing mechanism under the state that the first link of the first stabilizing mechanism is in parallel relationship with the third link of the first stabilizing mechanism and that the second link of the first stabilizing mechanism is in parallel relationship with the fourth link of the first stabilizing mechanism;

a second stabilizing mechanism including a first link having first and second end portions, the first link of the second stabilizing mechanism integrally formed with and in parallel relationship with the second arm link under the state that the second end portion of the first link of the second stabilizing mechanism is connected with the second end portion of the second arm link, a second link having first and second end portions and substantially equal in length to the second link of the first stabilizing mechanism, the first and second links of the second stabilizing mechanism pivotably connected with each other at the second end portion of the first link of the second stabilizing mechanism and the first end portion of the second link of the second stabilizing mechanism, the second link of the second stabilizing mechanism integrally formed with and in axial alignment with the fourth arm link under the state that the first end portion of the second link of the second stabilizing mechanism is connected with the second end portion of the fourth arm link, a third link having first and second end portions and substantially equal in length to the first link of the second stabilizing mechanism, the second and third links of the second stabilizing mechanism pivotably connected with each other at the second end portion of the second link of the second stabilizing mechanism and the first end portion of the third link of the second stabilizing mechanism, the third link of the second stabilizing mechanism integrally formed with and in parallel relationship with the sixth arm link under the state that the first end portion of the third link of the second stabilizing mechanism is connected with the second end portion of the sixth arm link, and a fourth link having first and second end portions and substantially equal in length to the second link of the second stabilizing mechanism, the third and fourth links of the second stabilizing mechanism pivotably connected with each other at the second end portion of the third link of the second stabilizing mechanism and the first end portion of the fourth link of the second stabilizing mechanism, the fourth and first links of the second stabilizing mechanism

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5 pivotably connected with each other at the second end portion of the fourth link of the second stabilizing mechanism and the first end portion of the first link of the second stabilizing mechanism under the state that the first link of the second stabilizing mechanism is in parallel relationship with the third link of the second stabilizing mechanism and that the second link of the second stabilizing mechanism is in parallel relationship with the fourth link of the second stabilizing mechanism, the handling member having first and second portions, the fifth arm link and the handling member pivotably connected with each other at the first end portion of the fifth arm link and the first portion of the handling member, the sixth arm link and the handling member
10 pivotably connected with each other at the first end portion of the sixth arm link and the second portion of the handling member.

28. A robot arm mechanism as set forth in claim 16 which further comprising an additional handling member, the robot arm further comprising:
a third arm link having first and second end portion;
a fourth arm link having first and second end portion, the first, second, third, and fourth arm links substantially equal in length to each other;
a fifth arm link having first and second end portion;
a sixth arm link having first and second end portion; and
20 an additional link retaining mechanism having an additional center line, the additional link retaining mechanism pivotably retaining the third and fourth arm links respectively at the first end portions of the third and fourth arm links and keeping parallel two lines of the line passing through the first and second end portions of the third arm link and the symmetrical line with respect to the additional center line with
25 the line passing through the first and second end portions of the fourth arm link, the additional link retaining mechanism comprising a first joint cross linkage including a first short link having first and second end portions, a first long link having first and second end portions and longer than the first short link of the first joint cross linkage of the additional link retaining mechanism, the first short and long links of the first
30 joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the first short link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism, a second short link having first and second end portions and substantially equal in
35 length to the first short link of the first joint cross linkage of the additional link retaining mechanism, the first long link of the first joint cross linkage of the additional link retaining mechanism and the second short link of the first joint cross linkage of

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the additional link retaining mechanism pivotably connected with each other at the second end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the second short link of the first joint cross linkage of the additional link retaining mechanism, and a second long link having first and second end portions and substantially equal in length to the first long link of the first joint cross linkage of the additional link retaining mechanism, the second short and long links of the first joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the second short link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the second long link of the first joint cross linkage of the additional link retaining mechanism, the second long link of the first joint cross linkage of the additional link retaining mechanism and the first short link of the first joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the second long link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the first short link of the first joint cross linkage of the additional link retaining mechanism under the state that the second long link of the first joint cross linkage of the additional link retaining mechanism is crossed with the first long link of the first joint cross linkage of the additional link retaining mechanism, and a second joint cross linkage including a first short link having first and second end portions, a first long link having first and second end portions and longer than the first short link of the second joint cross linkage of the additional link retaining mechanism, the first short and long links of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the first long link of the second joint cross linkage of the additional link retaining mechanism, a second short link having first and second end portions and substantially equal in length to the first short link of the second joint cross linkage of the additional link retaining mechanism, the first long link of the second joint cross linkage of the additional link retaining mechanism and the second short link of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the first long link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the second short link of the second joint cross linkage of the additional link retaining mechanism, and a second long link having first and second end portions and substantially equal in length to the first long link of the second joint cross linkage of

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the additional link retaining mechanism, the second short and long links of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the second short link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the second long link of the second joint cross linkage of the additional link retaining mechanism, the second long link of the second joint cross linkage of the additional link retaining mechanism and the first short link of the second joint cross linkage of the additional link retaining mechanism pivotably connected with each other at the second end portion of the second long link of the second joint cross linkage of the additional link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism under the state that the second long link of the second joint cross linkage of the additional link retaining mechanism is crossed with the first long link of the second joint cross linkage of the additional link retaining mechanism, the length ratio of each of the first and second short links of the first joint cross linkage of the additional link retaining mechanism to each of the first and second long links of the first joint cross linkage of the additional link retaining mechanism substantially equal to the length ratio of each of the first and second short links of the second joint cross linkage of the additional link retaining mechanism to each of the first and second long links of the second joint cross linkage of the additional link retaining mechanism, the first short link of the first joint cross linkage of the additional link retaining mechanism integrally formed with and in parallel relationship with the first long link of the second joint cross linkage of the additional link retaining mechanism under the state that the second end portion of the first short link of the first joint cross linkage of the additional link retaining mechanism is connected with the first end portion of the first long link of the second joint cross linkage of the additional link retaining mechanism, the first long link of the first joint cross linkage of the additional link retaining mechanism integrally formed with and in parallel relationship with the first short link of the second joint cross linkage of the additional link retaining mechanism under the state that the first end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism is connected with the second end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism, the first end portion of any one of the third and fourth arm links integrally connected with the second short link of the first joint cross linkage of the additional link retaining mechanism, the first end portion of the other one of the third and fourth arm links integrally connected with the second long link of the second joint cross linkage of the additional link retaining mechanism, the distance between the second end portion of

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the first long link of the first joint cross linkage of the link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the link retaining mechanism is substantially equal to the distance between the second end portion of the first long link of the first joint cross linkage of the additional link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism, the handling member having a first and second portions, the additional handling member having a first and second portions, the first arm link and the handling member pivotably connected with each other at the second end portion of the first arm link and the first portion of the handling member, the third arm link and the handling member pivotably connected with each other at the second end portion of the third arm link and the second portion of the handling member, the fourth arm link and the additional handling member pivotably connected with each other at the second end portion of the fourth arm link and the first portion of the additional handling member, the second arm link and the additional handling member pivotably connected with each other at the second end portion of the second arm link and the second portion of the additional handling member, the arm driving mechanism comprising a first driving shaft rotatable around a rotation axis, and a second driving shaft in the form of a hollow shape to rotatably receive therein the first driving shaft and rotatable around the rotation axis, any one of the first and second driving shafts rotating the fifth arm link around the second end portion of the fifth arm link, the other one of the first and second driving shafts rotating the sixth arm link around the second end portion of the sixth arm link, the second end portions of the fifth and sixth arm links positioned on the rotation axis, the fifth arm link pivotable around the second end portion of the fifth arm link, the sixth arm link pivotable around the second end portion of the sixth arm link, the first end portion of the fifth arm link pivotally connected with the first long link of the first joint cross linkage of the link retaining mechanism or the first short link of the second joint cross linkage of the link retaining mechanism under the state that the first end portion of the fifth arm link is substantially equally spaced apart from the second end portion of the first long link of the first joint cross linkage of the link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the link retaining mechanism, the first end portion of the sixth arm link pivotally connected with the first long link of the first joint cross linkage of the additional link retaining mechanism or the first short link of the second joint cross linkage of the additional link retaining mechanism under the state that the first end portion of the sixth arm link is substantially equally spaced apart from the second end portion of the first long link of the first joint cross linkage of the additional link

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~~retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the additional link retaining mechanism.~~

29. A robot arm mechanism as set forth in claim 28 in which the robot arm further comprises a stabilizing mechanism including:

a first link having first and second end portions and substantially equal in length to the first arm link, the first link of the stabilizing mechanism integrally formed with and in coaxial relationship with the first arm link under the state that the first end portion of the first link of the stabilizing mechanism is connected with the first end portion of the first arm link;

a second link having first and second end portions, the first and second links of the stabilizing mechanism pivotably connected with each other at the second end portion of the first link of the stabilizing mechanism and the first end portion of the second link of the stabilizing mechanism, the second link of the stabilizing mechanism integrally connected with the handling member;

a third link having first and second end portions and substantially equal in length to the first link of the stabilizing mechanism, the second and third links of the stabilizing mechanism pivotably connected with each other at the second end portion of the second link of the stabilizing mechanism and the first end portion of the third link of the stabilizing mechanism; and

a fourth link having first and second end portions and substantially equal in length to the second link of the stabilizing mechanism, the third and fourth links of the stabilizing mechanism pivotably connected with each other at the second end portion of the third link of the stabilizing mechanism and the first end portion of the fourth link of the stabilizing mechanism, the fourth and first links of the stabilizing mechanism pivotably connected with each other at the second end portion of the fourth link of the stabilizing mechanism and the first end portion of the first link of the stabilizing mechanism under the state that the first link of the stabilizing mechanism is in parallel relationship with the third link of the stabilizing mechanism and that the second link of the stabilizing mechanism is in parallel relationship with the fourth link of the stabilizing mechanism, the second end portion of the fourth link of the stabilizing mechanism integrally formed with the first long link of the first joint cross linkage of the link retaining mechanism or the first short link of the second joint cross linkage of the link retaining mechanism.

30. A robot arm mechanism as set forth in claim 16 in which the robot arm further comprises:

a third arm link having first and second end portions and substantially equal in length to the first arm link, the second and third arm links pivotably connected with each other at the first end portion of the second arm link and the first end portion of the third arm link;

5 a fourth arm link having first and second end portions and substantially equal in length to the second arm link, the first and second arm links substantially equal in length to each other, the first and fourth arm links pivotably connected with each other at the first end portion of the first arm link and the first end portion of the fourth arm link;

10 a fifth arm link having first and second end portions and substantially equal in length to the distance between the second end portion of the first long link of the first joint cross linkage of the link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the link retaining mechanism, the first and fifth arm links pivotably connected with each other at the second end portion of the first arm link and the first end portion of the fifth arm link, the third and fifth arm links pivotably connected with each other at the second end portion of the third arm link and the second end portion of the fifth arm link under the state that the first long link of the first joint cross linkage of the link retaining mechanism and the fifth arm link are in parallel relationship with each other and that the first arm link and the third arm link are in parallel relationship with each other;

20 a sixth arm link having first and second end portions and substantially equal in length to the distance between the second end portion of the first long link of the first joint cross linkage of the link retaining mechanism and the first end portion of the first short link of the second joint cross linkage of the link retaining mechanism, the second and sixth arm links pivotably connected with each other at the second end portion of the second arm link and the first end portion of the sixth arm link, the fourth and sixth arm links pivotably connected with each other at the second end portion of the fourth arm link and the second end portion of the sixth arm link under the state that the first long link of the first joint cross linkage of the link retaining mechanism and the sixth arm link are in parallel relationship with each other and that the second arm link and the fourth arm link are in parallel relationship with each other, the handling member and the sixth arm link integrally formed with each other.

31. A robot arm mechanism as set forth in claim 30 in which the arm driving mechanism comprises a first driving shaft rotatable around a rotation axis, and a second driving shaft in the form of a hollow shape to rotatably receive therein the first driving shaft and rotatable around the rotation axis, any one of the first and second

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driving shafts integrally connected with the first arm link at the second end portion of the first arm link and rotating the first arm link around the rotation axis, the other one of the first and second driving shafts integrally connected with the fifth arm link at the first end portion of the fifth arm link and rotating the fifth arm link around the rotation axis.

32. A robot arm mechanism as set forth in claim 30 in which the arm driving mechanism comprises a first driving shaft rotatable around a rotation axis, and a second driving shaft in the form of a hollow shape to rotatably receive therein the first driving shaft and rotatable around the rotation axis, the rotation axis positioned on the line passing through the first and second end portions of the fifth arm link, the robot arm further comprising a driving assist parallelogram linkage including a first link having first and second end portions and substantially equal in length to the distance between the rotation axis and the second end portion of the first arm link, the first link of the driving assist parallelogram linkage integrally formed with and in coaxial relationship with the fifth arm link under the state that the second end portion of the first link of the driving assist parallelogram linkage is connected with the first end portion of the fifth arm link, a second link having first and second end portions, the first and second links of the driving assist parallelogram linkage pivotably connected with each other at the second end portion of the first link of the driving assist parallelogram linkage and the first end portion of the second link of the driving assist parallelogram linkage, the second link of the driving assist parallelogram linkage integrally formed with and in parallel relationship with the first arm link under the state that the first end portion of the second link of the driving assist parallelogram linkage is connected with the second end portion of the first arm link, a third link having first and second end portions and substantially equal in length to the first link of the driving assist parallelogram linkage, the second and third links of the driving assist parallelogram linkage pivotably connected with each other at the second end portion of the second link of the driving assist parallelogram linkage and the first end portion of the third link of the driving assist parallelogram linkage, and a fourth link having first and second end portions and substantially equal in length to the second link of the driving assist parallelogram linkage, the third and fourth links of the driving assist parallelogram linkage pivotably connected with each other at the second end portion of the third link of the driving assist parallelogram linkage and the first end portion of the fourth link of the driving assist parallelogram linkage, the fourth and first links of the driving assist parallelogram linkage pivotably connected with each other at the second end portion of the fourth link of the driving assist

- parallelogram linkage and the first end portion of the first link of the driving assist parallelogram linkage under the state that the first link of the driving assist parallelogram linkage is in parallel relationship with the third link of the driving assist parallelogram linkage and that the second link of the driving assist parallelogram linkage is in parallel relationship with the fourth link of the driving assist parallelogram linkage, any one of the first and second driving shafts integrally connected with the fourth link of the driving assist parallelogram linkage at the second end portion of the fourth link of the driving assist parallelogram linkage and rotating the fourth link of the driving assist parallelogram linkage around the rotation axis, the other one of the first and second driving shafts integrally connected with the fifth arm link and rotating the fifth arm link around the rotation axis.

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